Detecting Stack Emissions in Infrared

-”Smart” Focal Plane Arrays

What Does a Smart Array Provide?

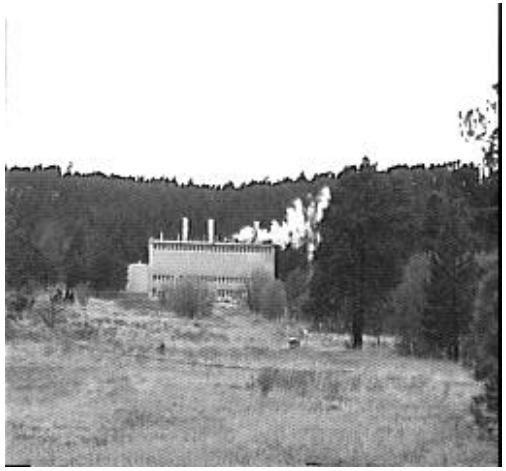
- The First Goal is to Extract Plumes and Laser Speckle Patterns from the Data
- Meeting these goals requires
  - Real-Time “Video” Processing for Machine Vision
    - Concurrent Spatial and Temporal Processing
    - Super High Bandwidth Bus Technology
    - Ultra High Performance Digital Signal Processing

1st Step in Meeting These Requirements:

- Algorithms
  - Lowpass Spatial filtering for noise reduction
  - 256x256 Bandpass temporal filters (at 10 Hz to start) for motion detection
  - Nonlinear spatial filter for shot noise reduction
- VME System Architecture
  - DataCube Image Acquisition from Infrared or CCD detector, Spatial Processing and Display
  - CNAPS massively parallel integer DSP for Temporal Processing
  - Quad TI TMS320C40 floating point DSP for Neural Processing
  - mv167 Single Board Computer for Control and Timing

Data Examples:

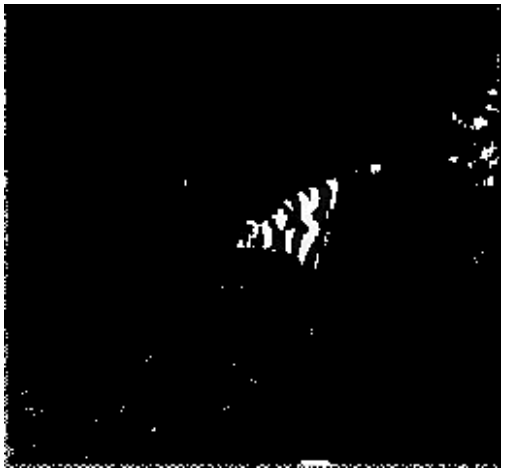
- Raw data contains a plume which we try and extract from a complex background scene



- Low Pass Filter reduces noise in image

Data Examples cont:

- Bandpass filtering in time extract motion but generates shot noise

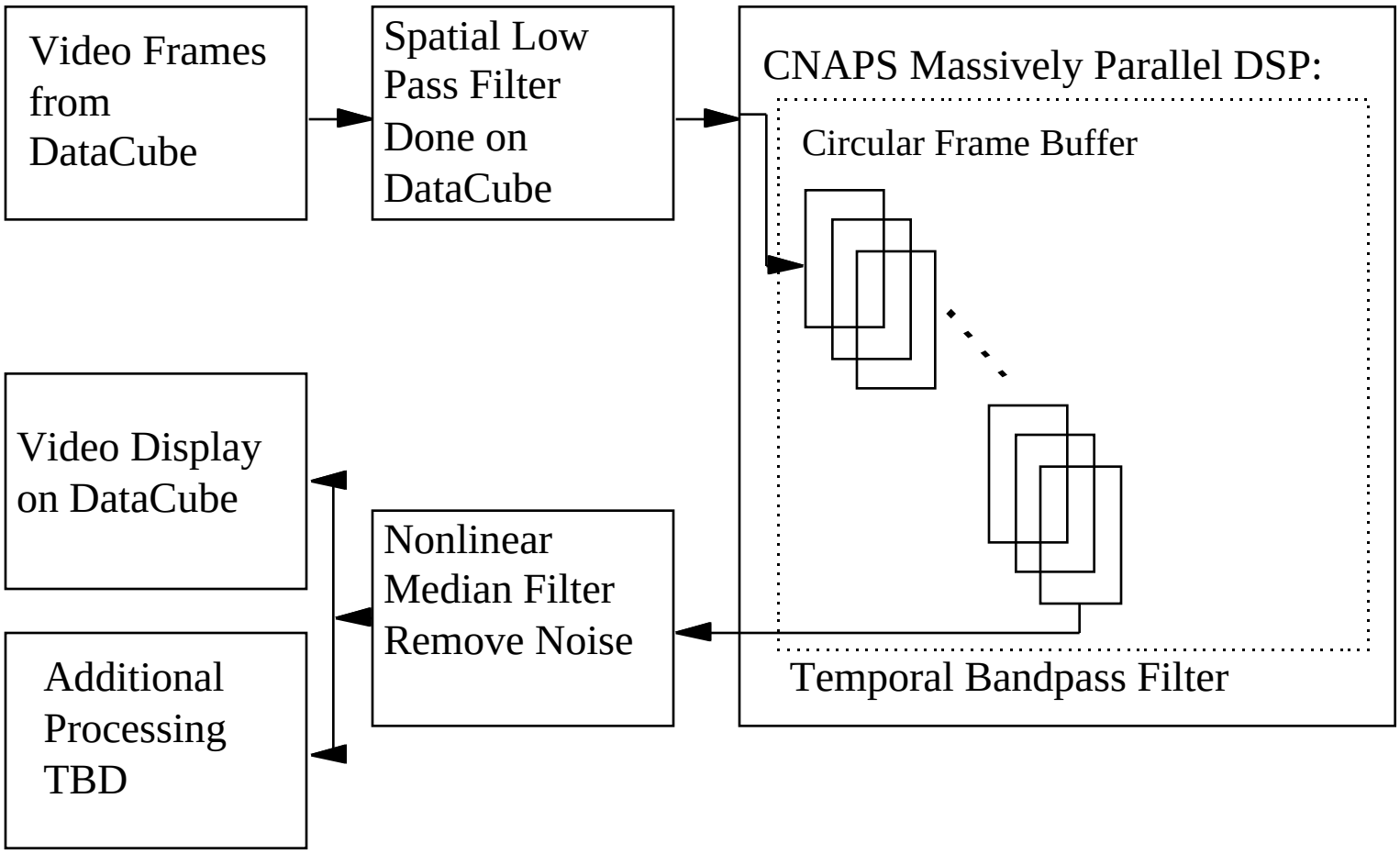


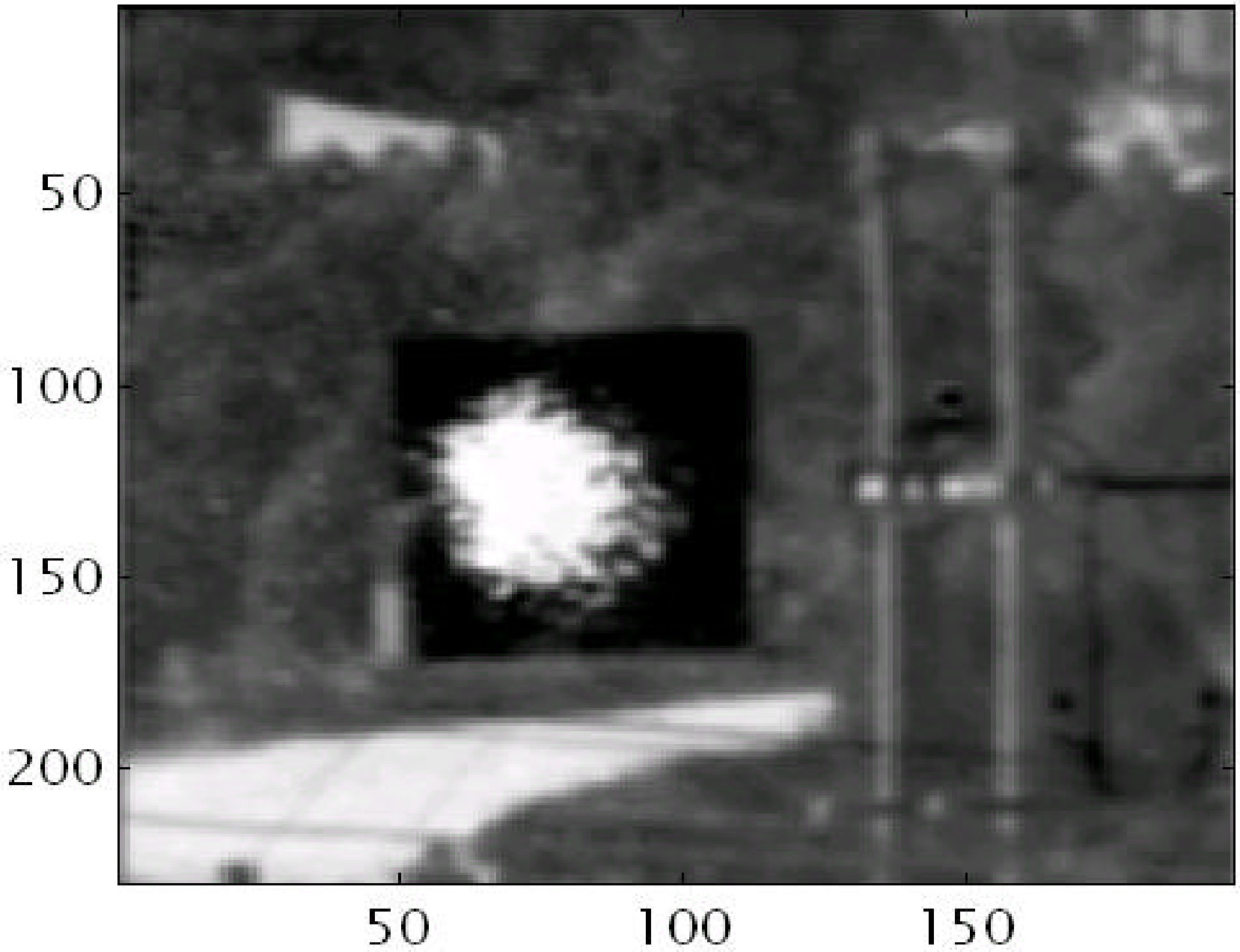
- Nonlinear median filter executed spatially reduces shot noise.

Tools and Methods for the Future:

- Tools
  - Vision ASICs will provide smarter detectors, offloading some processing
  - Reconfigurable Computing Machines (FPGA's as DSPs) will provide 100x more DSP power
  - Cross Port Switch bus technology will provide 100x more data throughput
- Methods
  - Region Growing assures acquisition of entire area of interest
  - Shape descriptors provide a metric of extracted Regions
  - Neural Net learns which regions are interesting

Data Flow Diagram

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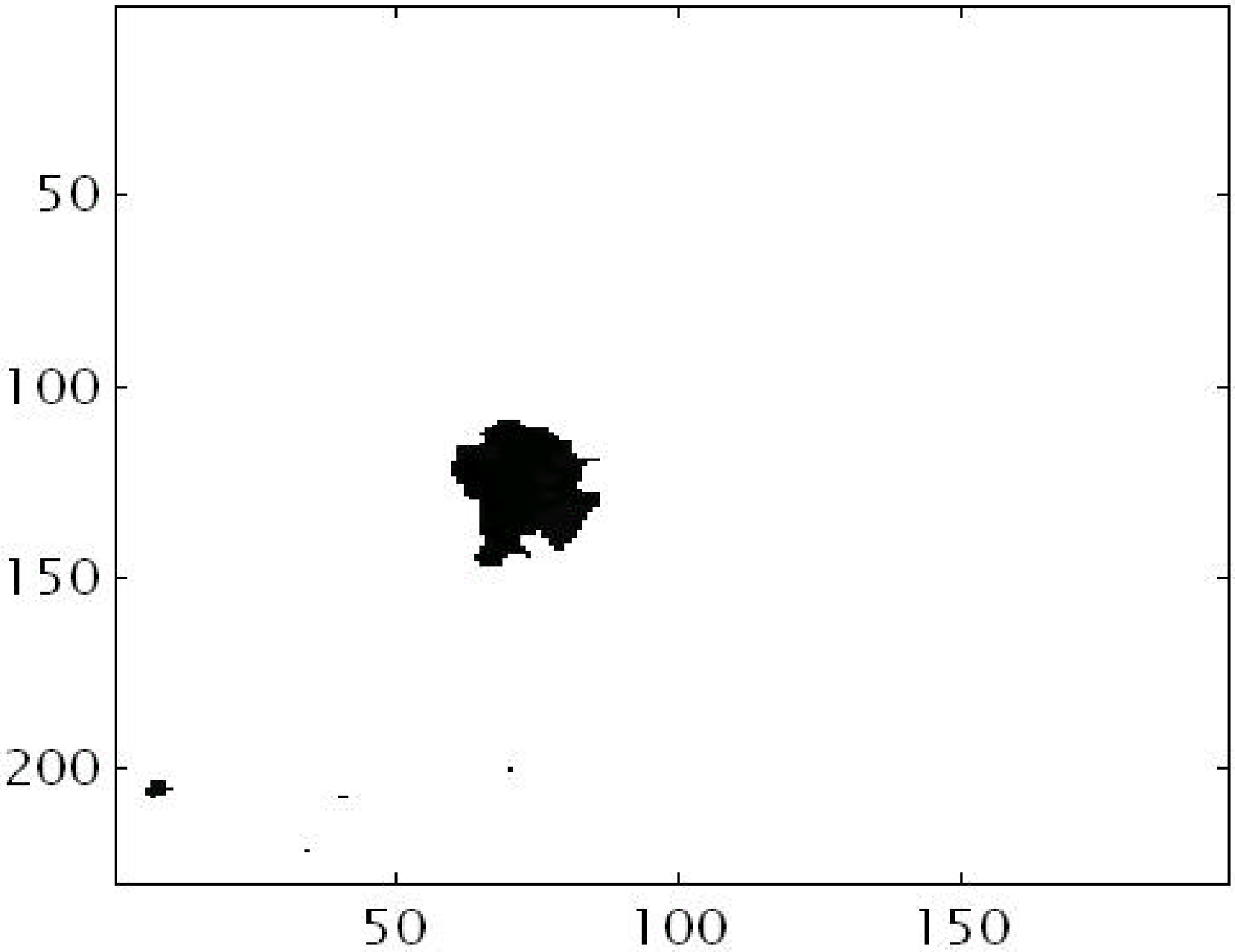
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